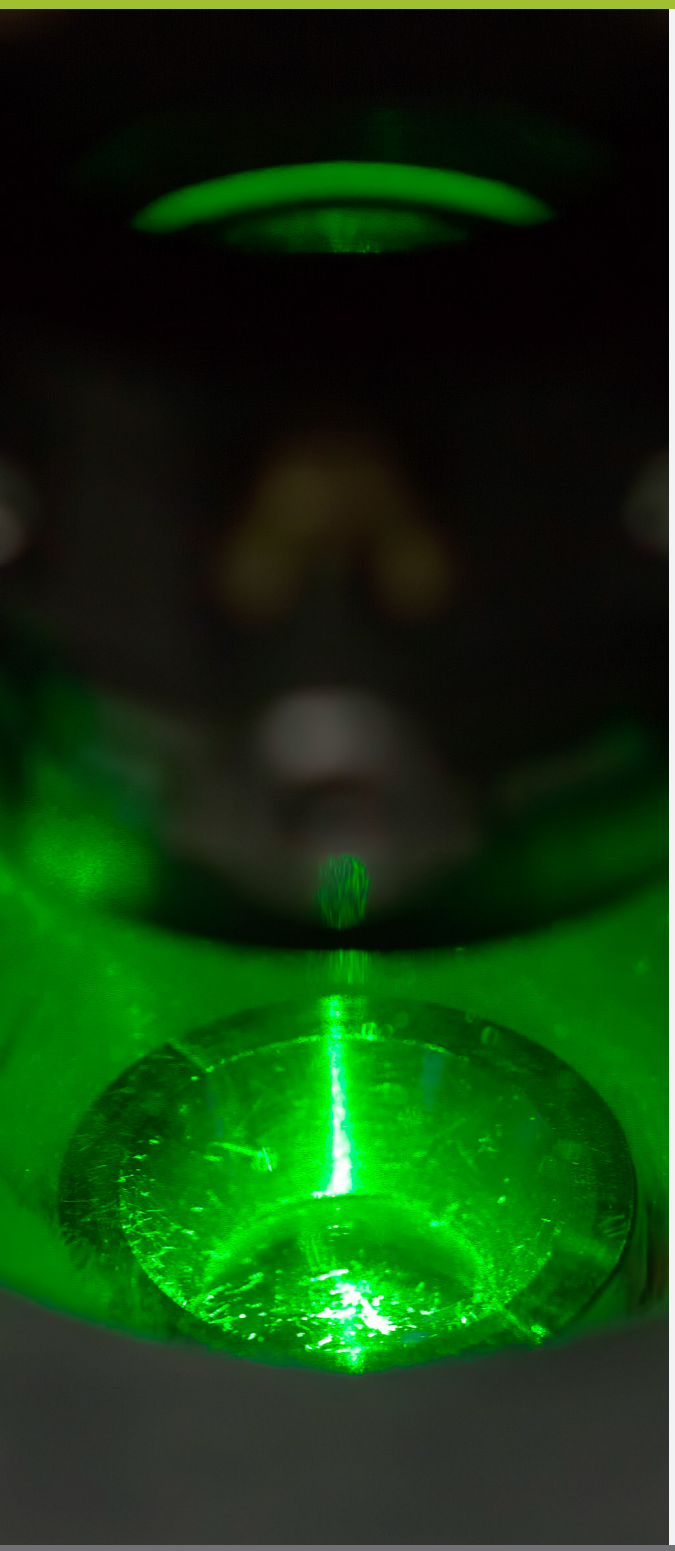
Available for Licensing

NATIONAL ENERGY TECHNOLOGY LABORATORY

A Unique Split Laser System for Environmental Monitoring



Opportunity:

Researchers at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) have developed a novel split laser system for in situ environmental monitoring via Laser Induced Breakdown Spectroscopy (LIBS). The device provides continuous monitoring of gases, liquids, and solids without any prior sample collection or preparation. The design features fiber-coupled, optically-pumped, passively Q-switched lasers that are small, portable, low cost and robust enough for even downhole applications. The technology is available for licensing and/or further collaborative research with NETL.

Overview:

Environmental monitoring is highly important to oil and gas exploration companies, landowners, regulatory agencies, municipalities and any organization measuring emissions and pollutants. The majority of monitoring technologies, however, are expensive and labor intensive, often requiring sample collection and preparation which can dramatically alter the sample and its inherent components.

Laser Induced Breakdown Spectroscopy (LIBS), an atomic emission spectroscopy, offers solutions to the drawbacks of conventional environmental monitoring technologies. It provides rapid and relatively simple qualitative and quantitative elemental analysis. without the need for sample collection or preparation. Moreover, LIBS can be applied to in situ measurements of gases, liquids and solids, making it amenable to the monitoring of air, water, and soil. The majority of available LIBS systems, however, are large and complex, employing aboveground, laboratory-scale lasers, incompatible with monitoring under extreme conditions, such as high temperature and pressure.

(continued)

Principal Investigator:
Dustin McIntyre

NETL researchers have designed a simple, easy to fabricate, handheld LIBS system fully adaptable to field use and capable of measurements in harsh environments. NETL's system utilizes a passively-Q-switched laser, providing the same degree of precision timing as conventionally-employed actively-switched lasers, but with fewer components and a lower cost laser system. The NETL device boasts a unique split laser design coupled with solid state optics, allowing for both single- and mulltpoint at-a-distance monitoring, even within severe downhole environments.

Significance:

NETL's environmental monitoring technology provides:

- Rapid, sensitive, in situ measurements even under extreme conditions
- Flexibility of single or multipoint monitoring
- Minimal complexity with low fabrication costs
- Assessment of solids, liquids, and gases in a broad array of applications

Applications:

- Long-term CO_2 sequestration monitoring, obtaining surface, near-surface and subsurface measurements of CO_2 post injection to validate storage and detect leakage
- Assessing downhole fluid chemisty before and after hydrofracturing
- Municipal water treatment and filtration systems, providing on-line quantitative measurements of impurities and contaminants
- Offshore oil and gas industry, providing analysis of produced water prior to discharge/disposal
- Pollution/contaminant monitoring and remediation, assessing ground water quality, air quality (indoor and outdoor) and soil composition

Related Patents and Patent Applications:

- US Patent No. **7,421,166** issued September 2, 2008, titled "Laser Spark Distribution and Ignition System." Inventors: Steven Woodruff and Dustin McIntyre
- US Patent No. **8,786,840** issued July 22, 2014, titled "Method and Device for Remotely Monitoring an Area Using a Low Peak Optical Pump." Inventors: Steven Woodruff, Dustin McIntyre and Jinesh Jain
- US Non-Provisional Patent Application No. **14/800,959** filed July 16, 2015, titled "Laser Spark Distribution and Ignition System." Inventors: Steven Woodruff and Dustin McIntyre
- US Patent No. **8,934,511** issued January 13, 2015, titled "Laser Interlock System." Inventors: Steven Woodruff and Dustin McIntyre
- US Patent No. **9,297,696** issued March 29, 2016, titled "Laser Based Analysis Using a Passively Q-Switched Laser." Inventors: Steven Woodruff and Dustin McIntyre

NATIONAL ENERGY TECHNOLOGY LABORATORY

1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

For more information:
Jessica Sosenko
Technology Transfer Manager
jessica.sosenko@netl.doe.gov
412-386-7417

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681